MOORE INDUSTRIES WORLDWIDE
Demand Moore Reliability

No. 178-717-00M
June 2018



PC-Programmable Loop Display

PSD

User's Manual

Demand Moore Reliability

Customer Support

Moore Industries is recognized as the industry leader in delivering top quality to its customers in products and services. We perform a sequence of stringent quality assurance checks on every unit we ship. If any Moore Industries product fails to perform up to rated specifications, call us for help. Our highly skilled staff of trained technicians and engineers pride themselves on their ability to provide timely, accurate, and practical answers to your process instrumentation questions. Our headquarters and other facilities phone numbers are listed below.

There are several pieces of information that can be gathered before you call the factory that will help our staff get the answers you need in the shortest time possible. For fastest service, gather the complete model and serial number(s) of the problem unit(s) and the job number of the original sale.

Locations

World Headquarters

16650 Schoenborn Street
North Hills, California
91343-6196, **U.S.A.**
Tel: (818) 894-7111
Fax: (818) 891-2816
E-mail: info@miinet.com
TOLL FREE: 1-800-999-2900
www.miinet.com

China

Room 402, No. 57,
Lane 651, Xipu Road,
Xinqiao Town, Songjiang District,
Shanghai, 201612, P. R. China
Tel: 86-21 62491499
Fax: 86-21 62490635
E-mail: sales@mooreind.sh.cn
www.miinet.com/cn

Europe

1 Lloyds Court, Manor Royal, Crawley
W. Sussex RH10-9QU
United Kingdom
Tel: 01293 514488
Fax: 01293 536852
FREE PHONE: 0800 525107
sales@mooreind.com
www.miinet.com/uk

Guido Gezellestraat 106
BE-2630 Aartselaar
Belgium
Tel: 03/448.10.18
Fax: 03/440.17.97
info@mooreind.be
Dutch: www.miinet.com/dbe
French: www.miinet.com/fbe

Burg Meslaan 98
4003 CD Tiel
The Netherlands
Tel: (0)344-617971
Fax: (0)344-615920
sales@mooreind.nl
www.miinet.com/nl

Australia

Sydney, NSW
3/1 Resolution Drive
Caringbah, New South Wales 2229
Australia
Tel: (02) 8536-7200
Fax: (02) 9525-7296
sales@mooreind.com.au
www.miinet.com/au

Perth, WA
6/46 Angove Street
North Perth, Western Australia 6006
Australia
Tel: (08) 9228-4435
Fax: (08) 9228-4436
sales@mooreind.com.au
www.miinet.com/au

www.miinet.com

Table of Contents

Introduction

This is the user's manual for the PSD, Moore Industries' PC-Programmable Loop Display. It contains all of the information needed to configure, install, operate and maintain the PSD.

The following guidelines are used in this manual:

WARNING - Hazardous procedure or condition that could injure the operator.

Caution - Hazardous procedure or condition that could damage or destroy the unit.

Note - Information that is helpful for a procedure, condition or operation of the unit.

The PSD

The PSD is a 2-wire (loop-powered), PC-programmable loop display. Typically paired with one of our extensive line of durable housing and enclosure options, its size, accuracy, and low voltage drop make it the ideal solution for displaying measurements in remote or otherwise difficult-to-access locations or nearly overburdened loops.

Model and Serial Numbers

Moore Industries uses the model and serial numbers of our instruments to track information regarding each unit that we sell and service. If a problem occurs with your instrument, check for a tag affixed to the unit listing these numbers. Supply the Customer Support representative with this information when calling.

Specifications

Performance

Input Accuracy: ±0.012% of input scale
Overall Accuracy: The overall accuracy of the unit is the input accuracy. (±0.012% of input scale) It includes the combined effects of linearity, hysteresis, repeatability, and adjustment resolution. It does not include ambient temperature effect.
Stability: Error is in % of maximum span

Stability	Input to Output		
	1yr	3yrs	5yrs
mA	0.08	0.14	0.18

Resolution: 0.0028% of input scale
Over-Current Protection: 100mA maximum
Input Overrange: 24mA
Digital Input Filter: User-programmable; 50 or 60 Hz

Performance (Continued)

Excitation Current: ≥3.8mA
Burden: <2.3VLP (<5.1VLP when –LMD option is installed and the PSD is disconnected from the loop)

Display

Type: LCD; Top Row, 10mm (0.4 inch) high black digits on a reflective background; Bottom Row, 6mm (0.23 inch) high black digits on a reflective background
Display Update Rate: 100msec
Format: Top row is five alphanumeric characters plus sign and decimal point; Bottom row is five alphanumeric characters
Range: -99999 to 99999
Minimum Display Span: 1.00

Ambient Conditions

Operating Range: -25°C to 85°C (-13°F to 185°F)

Ambient Conditions (Continued)

Storage Range: -45°C to 85°C (-49°F to 185°F)
Relative Humidity: 0-95%, non-condensing
Ambient Temperature Effect: ±0.015% of span per °C change, maximum
RFI/EMI Immunity: 20 V/m when tested according to SAMA 33.1 abc with 0.5% of span or less error; 20 V/m @ 80-1000MHz, 1KHz AM, when tested according to IEC1000-4-3-1995
Common Mode Rejection: 100dB @ 60Hz
Normal Mode Rejection: 30dB @ 60Hz

Weight

BH housing: 1.37 kg (3 lbs, 1.1 oz)
D2LC housing: 640g (1 lb, 6.3 oz)
HP-style housing: 150g (5.3 oz)

Specifications and Information subject to change without notice.

PSD

Ordering Information

Unit	Input	Output	Power	Options	Housings
PSD PC-Programmable Loop Display	**4-20MA** Loop Input	**PRG** Programmable with supplied configuration software to display a percent or any other EGU of up to 5 characters in length.	**2.3VLP** Loop Powered	**-LMD** Loop Maintenance Zener Diode provided at input terminals allowing the PSD to be removed from the loop without interrupting loop continuity (Burden: increases from <2.3 to <5.1VLP when PSD is removed from the loop) **-ISC:** CSA Approved Intrinsically-Safe & Non-Incendive **-ISE:** ATEX Approved Intrinsically-Safe **-ISF:** FM Approved Intrinsically-Safe & Non-Incendive **-VTD:** Standard Factory Calibration with NIST Test Data Report	**BH2NG*** (*) or (‡) Aluminum 2-Hub, Explosion-Proof enclosure with two, ½-inch NPT entry ports and a glass cover **BH2TG*** (*) or (‡) Aluminum 2-Hub, Explosion-Proof enclosure with two, ¾-inch NPT entry ports and a glass cover **BH2MG*** (*) or (‡) Aluminum 2-Hub, Explosion-Proof enclosure with two, M20 x 1.5 entry ports and a glass cover **BH3NG*** (*) or (‡) Aluminum 3-Hub, Explosion-Proof enclosure with three, ½-inch NPT entry ports and a glass cover **BH3TG*** (*) or (‡) Aluminum 3-Hub, Explosion-Proof enclosure with two, ¾-inch NPT side-entry ports, one ½-inch NPT bottom-entry port, and a glass cover **BH3MG*** (*) or (‡) Aluminum 3-Hub, Explosion-Proof enclosure with two, M20 x 1.5 side-entry ports, one ½-inch bottom-entry port, and a glass cover **D1LC** 1-Hub, Low base, Clear cover, NEMA 4X (IP66) enclosure **D2LC** 2-Hub, Low base, Clear cover, NEMA 4X (IP66) enclosure **HP** Hockey-puck housing and spring clips **DN** Snap-in mounting for HP case on TS-32 DIN rail **FL** Mounting flanges on HP suitable for relay track or screw mounting **FLD** Mounting flanges on HP suitable for 3½" relay track or screw mounting **SB2NG*** (*) or (‡) 316 Stainless Steel 2-Hub, Explosion-Proof enclosure with two, ½-inch NPT entry ports and a glass cover **SB2MG*** (*) or (‡) 316 Stainless Steel 2-Hub, Explosion-Proof enclosure with two, M20 x 1.5 entry ports and a glass cover * Either **A** or **E** suffix (comes supplied with 2" pipe mount hardware) A suffix indicates ANZEx/TestSafe (Ex d) Flameproof approvals (i.e. BH2MGA) E suffix indicates ATEX (Ex d and tb) Flameproof approvals (i.e. BH2MGE) ‡ P suffix indicates enclosure comes equipped with base plate and U-bolts for mounting on a 2-inch pipe (i.e. BH2NGP) See BH, SB and D-BOX Datasheets for additional information.

To order, specify: Unit / Input / Output / Power / Options [Housing]
Model Number Example: PSD / 4-20MA / PRG / 2.3VLP / -LMD [BH2NG]

Figure 1. PSD Explosion-Proof BH Enclosure Dimensions

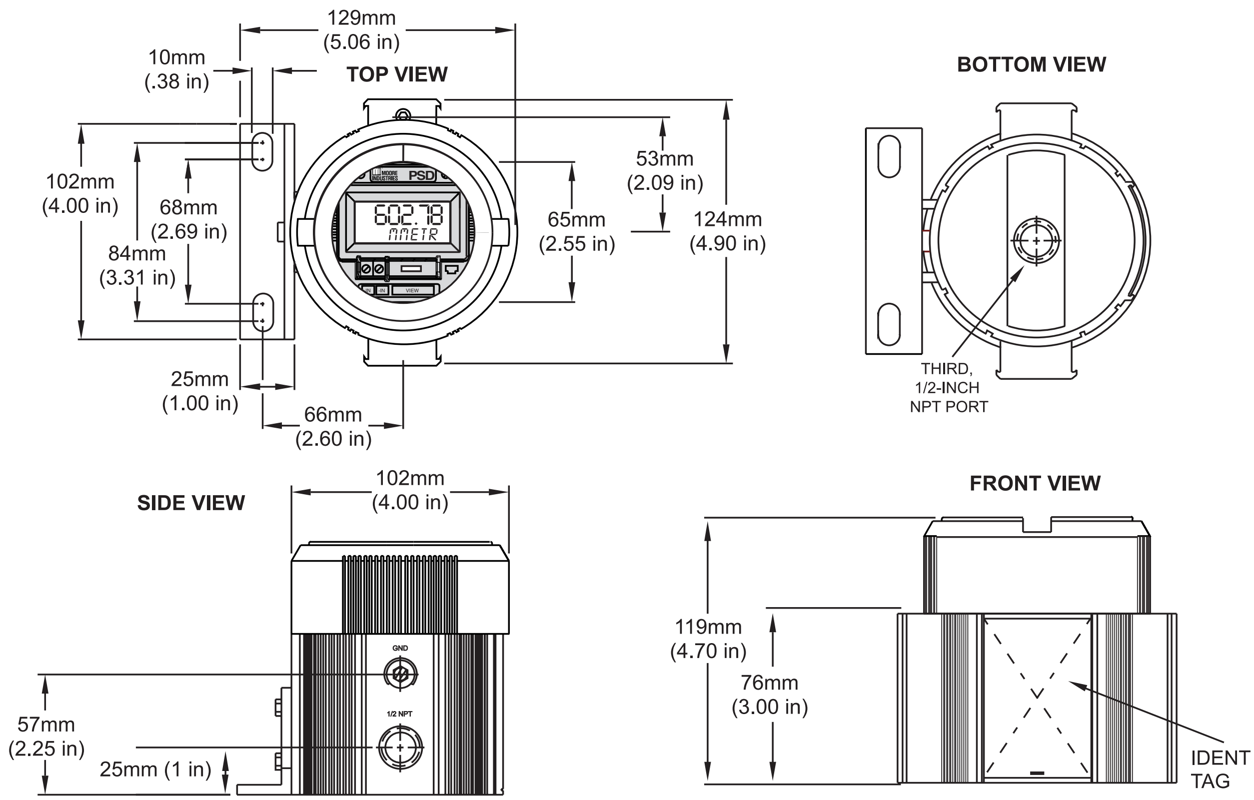


Figure 2. PSD Hockey-Puck Dimensions

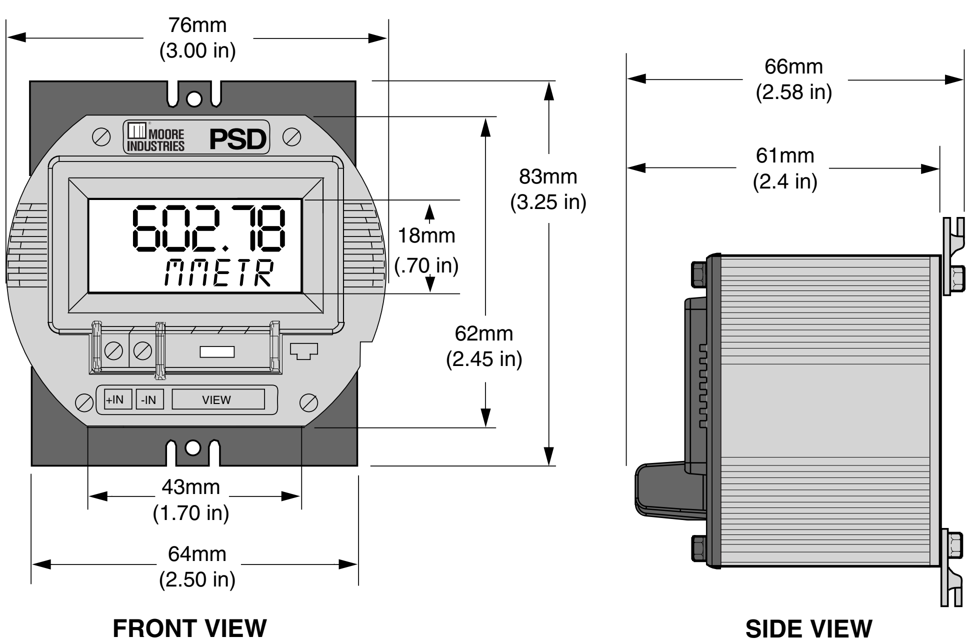
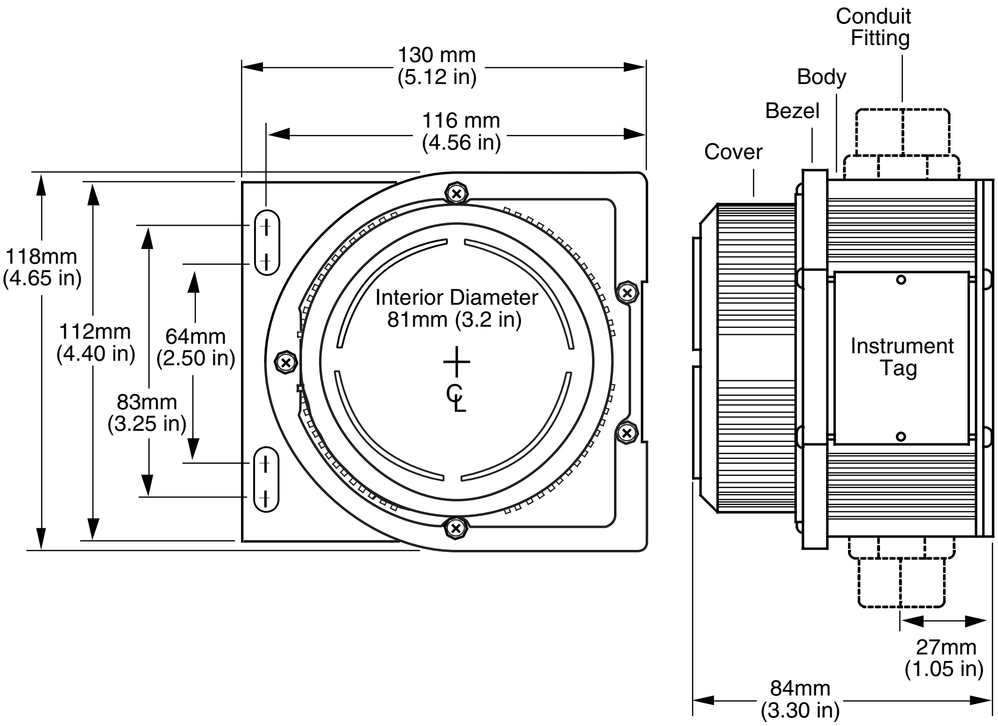


Figure 3. Field-Mount, NEMA 4X/IP66 D-BOX Enclosure Dimensions



Configuring the PSD

One of the benefits of the PSD is that it has no internal or external controls to adjust or settings to change. All operating parameters are set using Moore Industries' Intelligent PC Configuration software.

Once these software settings are made, they are downloaded to the instrument in the form of a Configuration File and stored in the unit's non-volatile memory. You can choose to save a backup copy of the file on your PC hard drive or other external media. The transmitter communicates with the PC through a cable connection to the PC's serial (COM) port or optional USB cable.

The serial cable is P/N 803-040-26 and the USB cable is P/N 804-030-26.

No PSD Required

It is not necessary to connect the display to a PC while creating configuration files using the Configuration Software. The Configuration Program can be run without connecting a PSD, and ***most*** operating parameters can be set without benefit of an attached unit.

This makes it easy to create a set of operating parameters, save and download them to one or more transmitters at a later time.

The PSD ***must*** be connected to the PC in order to: capture input, assign a tag, receive (via download) a configuration file and save the configuration file from the instrument's memory.

Installing the Configuration Software

Refer to Table 1 for the equipment needed.

1. Insert the *Moore Industries Interface Solution PC Configuration Software* CD into the CD drive of the PC. Access the CD and open the *PSD SPD PC Configuration Software* folder.
2. Double-click the installation program located in the folder. Follow the prompts to correctly install the program.

Once the Configuration Program is installed on the PC, the PSD can be connected to the loop or to equipment to simulate and calibrate input. You can then view and/or change the instrument's parameters.

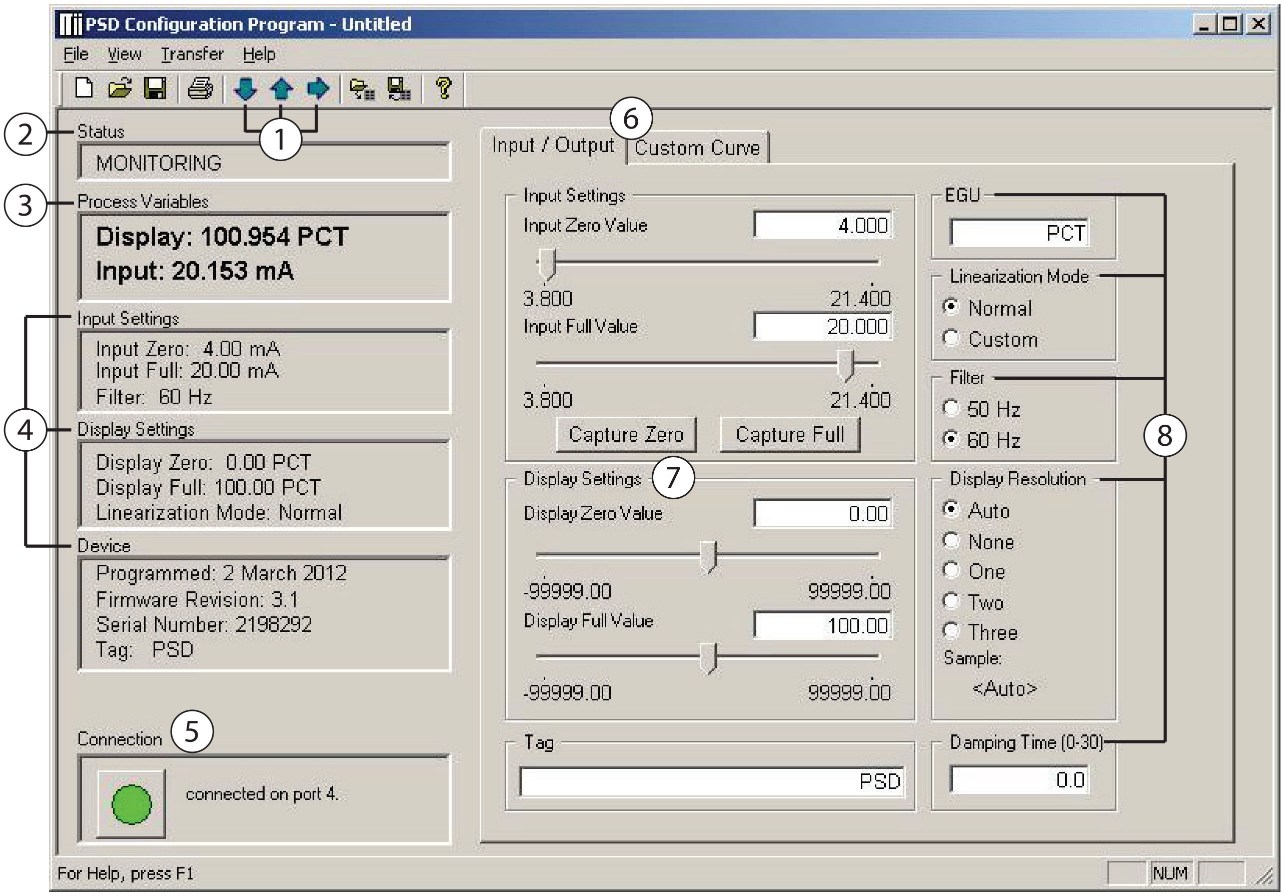
Default/Factory Configurations

The following are the default factory settings for your unit:

Input:
- 4-20mA
- Filter: 60Hz
- Damping Time: 0.0

Display:
- 0-100 PCT
- Display Resolution: AUTO
- Linearization Mode: Normal

Figure 4. Most of the PSD Operating Parameters can be set from the Main Screen of the Configuration Program.



Using the PC Program

The PSD PC Configuration Software is used to program all of the PSD's parameters. The PC Software is made up of these sections:

1. **Arrow Buttons**–Three Arrows here are used for *Downloading to Unit (down Arrow), Uploading from Unit (Up Arrow)*,or *Get Set-up (Right Arrow)*.

Note:
After uploading file (by pressing the Up Arrow), you must press the Right Arrow button to populate all information into the configuration dialog area.

2. **Status**–This portion of the screen displays the activity of the connected unit. It will show you if the unit is *Idle*, *Uploading*, *Downloading*, or *Monitoring*.

3. **Process Variables**–This displays two variables: the loop signal in mA and the loop signal after the PSD has converted it to the designated EGU.

4. **Input Settings, Output Setings, Tag, and Device**–These three sections display the configuration of the connected PSD.

5. **Connection**–Check this section to track the status of the PC's connection with the PSD.

6. **Input/Output & Custom Curve Tabs**–Displays all the information to program the PSD with either a standard, linear curve (Input / Output), or with a custom linearization curve (Custom Curve).

6. **Input Configuration**–Displays the input settings proposed for the transmitter. The two different capture buttons permit you to capture the input span.

7. **Display Configuration**–Shows the display settings proposed for the PSD.

8. **Engineering Units (EGU), Linearization Mode, Filter, Display Resolution, and Damping Time**–This set of radio buttons and edit boxes allow you to input different
values proposed for transmission to the PSD.

Connecting the PSD to PC

It is recommended that the PSD be installed in the loop before it is configured so that you can use the input capture feature to capture the exact full and zero values of the loop. See Figure 5 for a hookup diagram, and Table 1 for a list of necessary equipment.

If it is not possible to hookup the PSD to the loop, you can also use a variable current source and an ammeter or multimeter to setup your unit before you install it on the loop. See Figure 6 for a hookup diagram, and Table 1 for a list of necessary equipment. The PC Configuration Software can program and save the settings for the PSD without having a PSD attached, but you do need to attach the PSD as shown below in order to download information.

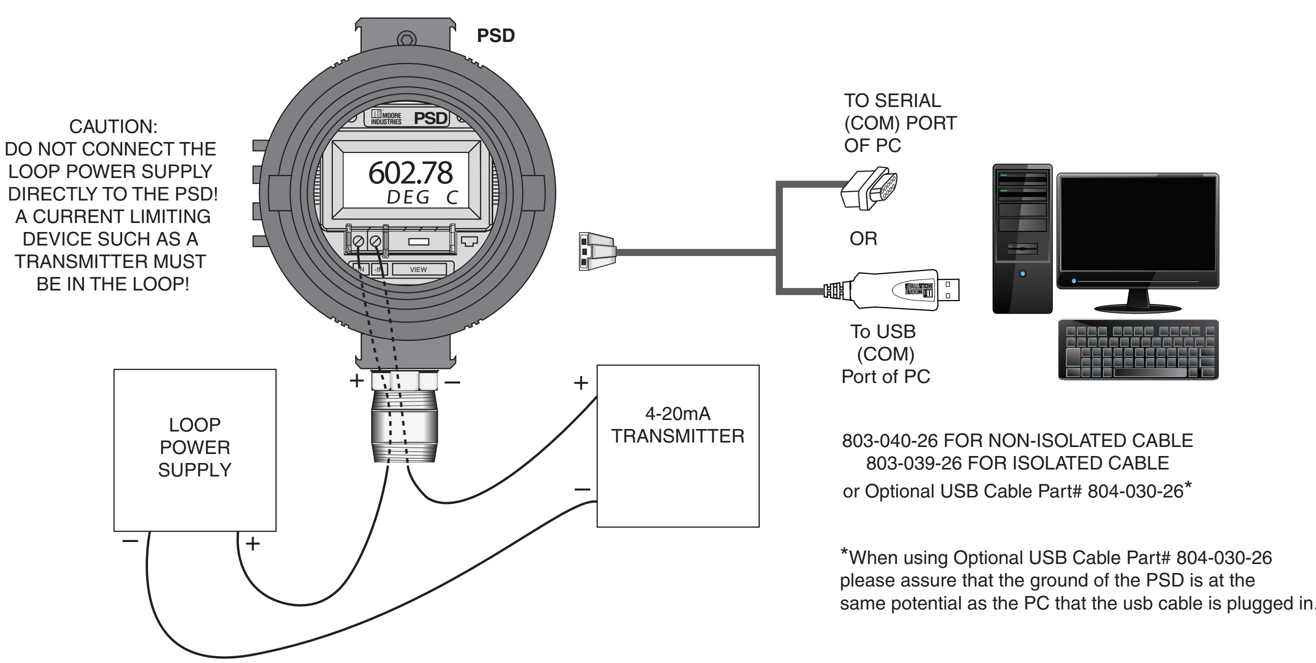
Caution: Unplugging the programming cable or resetting power while downloading to the unit could result in a default configuration / calibration and the unit may have to be returned to the factory.

Table 1. *Assembling the necessary equipment.*

Device	Specifications
Multimeter or Ammeter (optional)	Accurate to ±0.025% of span
Variable Current Source	Capable of 4-20mA; accurate to ±0.01% of span
Personal Computer	Microsoft Windows-based PC; 16Mb free RAM; 20Mb free disk space on hard drive 1 (one) serial port or one USB port (with optional cable)
PC Operating System	Microsoft Windows® XP, 7 or 10
Moore Industries PC Configuration Software	Version 1.0 or higher, successfully installed onto the hard drive

NOTE:
1. Terminal blocks can accommodate 14-22 AWG (2.08-0.33 mm^2) solid wiring.
2. Tighten terminals to 4 In-lb (0.45 Nm), maximum.

Figure 5. *Connecting the PSD to a 4-20mA Loop*



Square Roots and the Curve Generator

Moore Industries provides two options for customers who require a custom square root linearization table. You can either generate a custom curve table or import a pre-made curve.

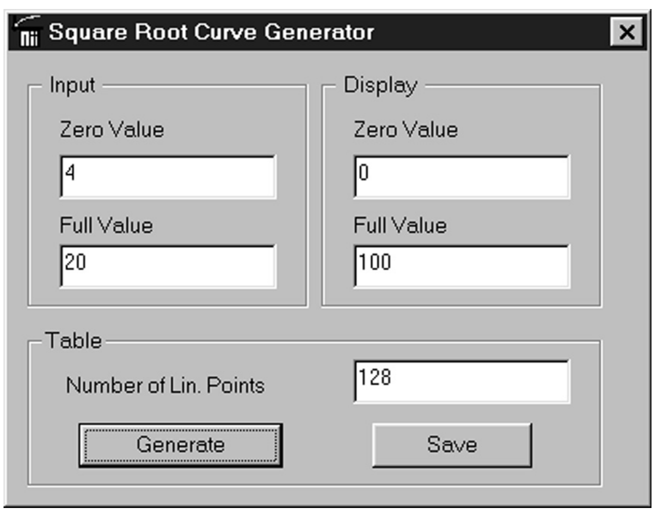
Option One: Generating a Custom Curve

The first option is to run the Table Generator and generate a custom table that can be easily saved and imported into the Universal PC Configuration Software.

To generate your own table, follow the instructions below.

1. From the START Menu, click on PROGRAMS, MOORE INDUSTRIES, then CURVE GENERATOR. The program that is shown below will appear.

Figure B-1. *The Square Root Curve Generator program will allow you to easily create any custom square root curve that you need.*



2. Enter the values for the input and display into the appropriate boxes. Enter the number of linearization points that you would like generated into the NUMBER OF LIN. POINTS box.

3. Click on GENERATE to create the table, then enter the name you would like the table saved as.

4. Close the Curve Generator and open the Universal PC Configuration Software. Click on the FILE menu, then on IMPORT CUSTOM CURVE. Select the "view all files" on the OPEN dialog box, then find the file name that you just saved.

5. Verify all settings.

6. Use the download button to transmit the new file to the PSD and finish the process.

Option Two: Importing a Pre-made Curve

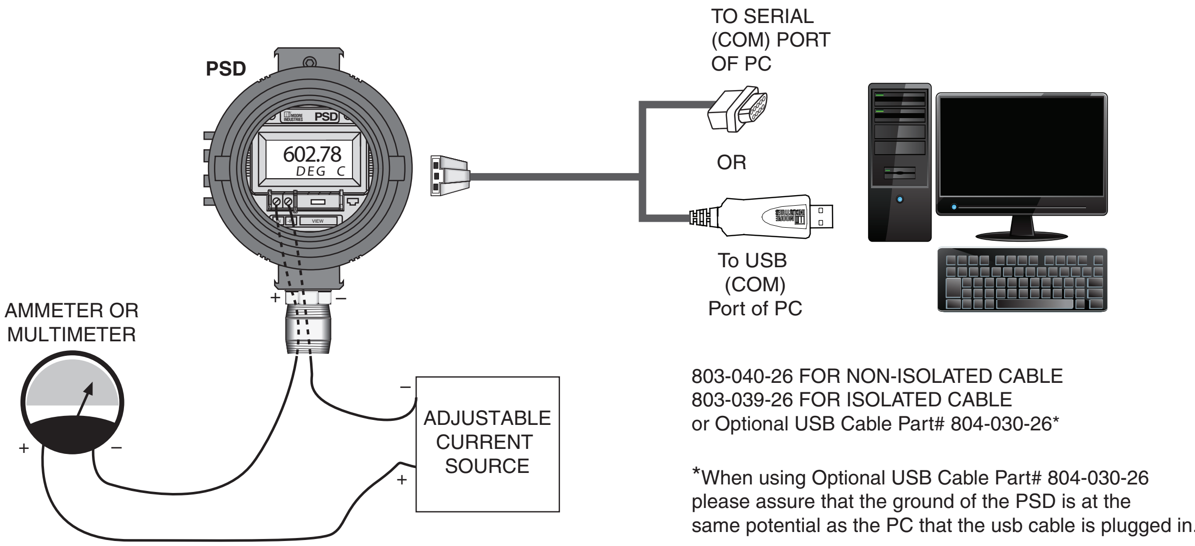
The second option is to use a pre-made custom curve table that will work the function. To import the file, follow the instructions below.

1. In the Universal PC Configuration Program, click on the FILE menu, then on IMPORT CUSTOM CURVE. Select the "view all files" on the OPEN dialog box, then navigate to the location in the filesystem of the custom curve of interest and click OPEN. The Universal PC Configuration Software will import the file.

2. Verify all settings.

3. Use the download button to transmit the new file to the PSD and finish the process.

Figure 6. Connecting the PSD to configuration equipment



Programming the PSD

There are two sections for programming the PSD – "Input/Output," and "Custom Curve". The Input/Output tab allows you to program the PSD with a normal, linear curve; the "Custom Curve" allows you to program the PSD with a custom linearization curve.

Programming the PSD with a Normal (linear) Curve

It is a simple process to program the PSD with a normal curve. Using the "Input/Output" tab, you will need to adjust the following settings.

1. In the "Input Settings" box, enter the Zero and Full Input values, or click the "Capture" buttons (this is the preferred method) and adjust the input.

2. Go to "Display Settings" and input the range you would like displayed on the PSD's screen.

3. Enter a name for the unit (to be read by the PC Program) in the "Tag" box.

4. Enter into the "EGU" box the engineering unit you would like displayed.

5. "Linearization Mode" should be left at "Normal".

6. Set the "Filter" to match the frequency of the filter for the AC power mains in your country.

7. Set the "Display Resolution" to the number of decimal points you would like the PSD to display.

8. Smooth out input variations by increasing the Damping Time.

9. Download the new settings to the instrument by attaching the instrument to the PC and clicking on the download button.

Programming the PSD with a Custom Curve

There are a variety of ways to program the PSD with a custom curve. You can import a comma-delimited table that you have written in another program (for example, design the table in Microsoft® Excel and save it as .csv type). You can import a ready-made file that came with your configuration software (such as the square root table). Or, you can set your own custom curve by follwing the directions described below.

1. Set the "Linearization Mode" to "Custom". In the "Linearization Data" box, enter the number of linearization points. Then, in the "X data" column of the table, enter the value of the loop input in mA. In the "Y data" column of the table, enter the corresponding EGU value that you would like displayed. Do this for each point of your custom curve. It may be useful to use the buttons in the "Commands" box to work with the custom curve table cells.

2. Set the "Input Settings" to the span of the loop you will be reading.

3. Set the "Display Settings" to the span that you would like to have displayed. This allows you to reset the range of the display with one step instead of needing to recalculate the entire custom curve table.

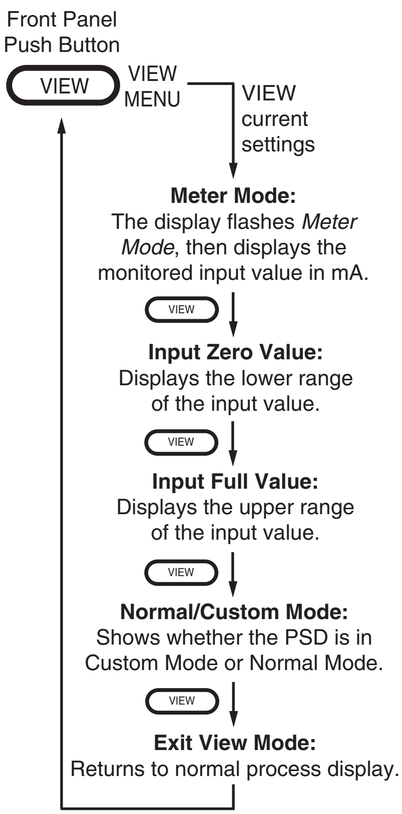
4. Click on the "Input/Output" tab so that you can set the Filter, Display Resolution, and Damping Time to the appropriate values.

5. Download the new settings to the instrument by attaching the instrument to the PC and clicking on the download button.

Site-Viewing the Configuration

Even after your PSD has been installed in the field, it is easy to verify its configuration using the front-mounted View button. Figure 7 describes the various displays controlled by the View button.

Figure 7. *The View button on the front of the PSD allows you view the different PSD settings.*



Installation

Installing the PSD in your loop involves mounting and making electrical connections.

Recommended Ground Wiring Practices

Moore Industries recommends the following ground wiring practices:

- Any Moore Industries product in a metal case or housing should be grounded.
- The protective earth conductor must be connected to a system safety earth ground before making any other connections.
- All input signals to, and output signals from, Moore Industries' products should be wired using a shielded, twisted pair wiring technique. Shields should be connected to an earth or safety ground.
- For the best shielding, the shield should be run all the way from the signal source to the receiving device. (see Note below)
- The maximum length of unshielded input and output signal wiring should be 2 inches.

Note:
Some of Moore Industries' instruments can be classified as receivers (IPT^2, IPX^2, etc.) and some can be classified as transmitters (TRX, TRY, etc.) while some are both a receiver and a transmitter (SPA^2, HIM, etc). Hence, your shield ground connections should be appropriate for the type of signal line being shielded. The shield should be grounded at the receiver and not at the signal source.

Electrical Connections

When installing any Moore Industries product, always follow all local regulations and standards for grounding, shielding, and safety.

WARNING: *Terminals on this unit may be connected to hazardous voltages. Before making ANY connections to this unit, always remove power from the loop instrument power terminals. or instrument power terminals.*

Installation Category
All terminals are rated CAT I.

Equipment Ratings
The PSD does not generate hazardous voltages. it provides a low current input.

WARNING: *If this unit is used in a manner not specified by Moore Industries, the protection provided by the equipment may be impaired.*

CE Conformity
Installation of any Moore Industries' products that carry the CE marking ***must*** adhere to the guidelines in the *Recommended Ground Wiring Practices* section in order to meet the EN 61326 requirements set forth in the applicable EMC directive.

WARNING: *If this unit is used in a manner not specified by Moore Industries, the protection provided by the equipment may be impaired.*

Operation
Once installed and programmed, PSD displays begin to operate immediately. Depending upon environmental conditions, they can be expected to operate unattended for extended periods of time.

Maintenance
Moore Industries suggests a quick check for terminal tightness and general unit condition every 6-8 months. Always adhere to any site requirements for programmed maintenance.

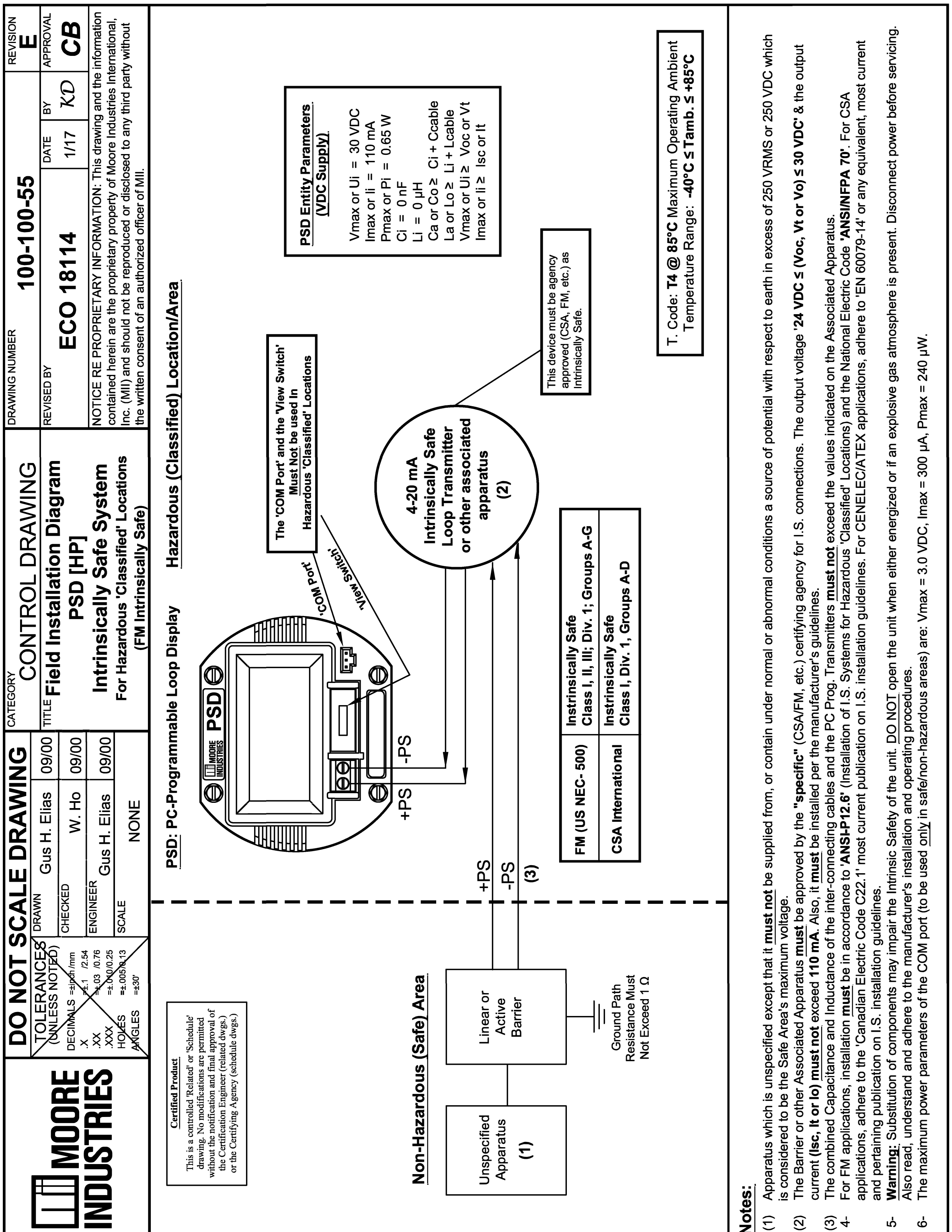
Customer Support
If service assistance is ever required for an device in your application, refer to the back cover of this manual for the telephone numbers to Moore Industries' customer service department.

If possible, make a note of the model number of the unit before calling. For fastest assistance, have the following information available: serial number, the job number and purchase order number under which it was shipped.

Intrinsic Safety

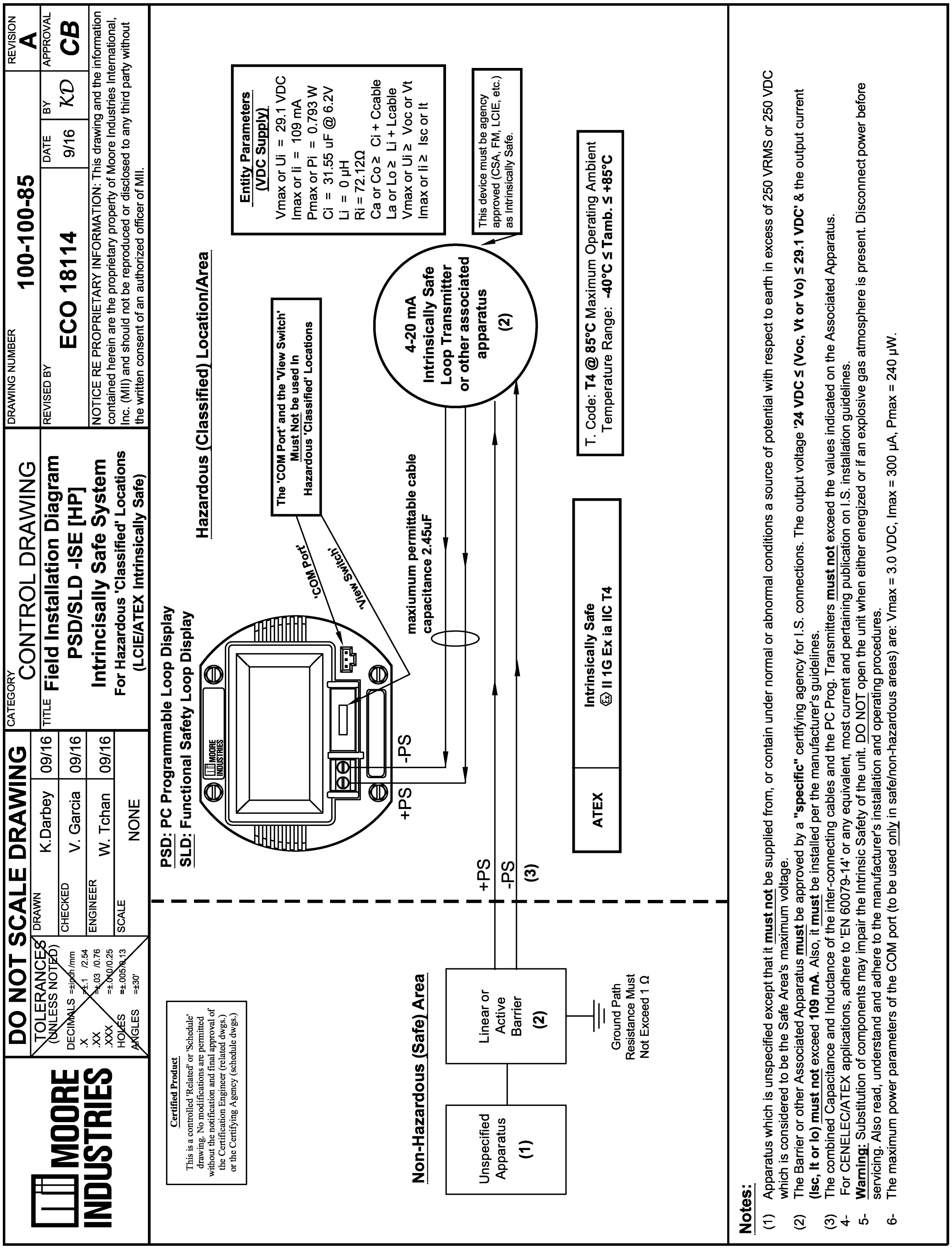
This page contains the installation diagram for the PSD carrying the intrinsically safe option (FM/CSA). It also includes guidelines for setting up zener barriers necessary in these types of applications.

These diagrams must be used to augment the installation instructions earlier in this manual for units that are to operate in areas requiring intrinsically safe instrumentation.



This page contains the installation diagram for the PSD carrying the intrinsically safe option (ATEX/). It also includes guidelines for setting up zener barriers necessary in these types of applications.

These diagrams must be used to augment the installation instructions earlier in this manual for units that are to operate in areas requiring intrinsically safe instrumentation.



Installation in Hazardous Locations

This section contain important information regarding the installation of the PSD in Hazardous Area Locations

WARNING:
Do not separate power connector when energized.

WARNING:
Substitution of components is not allowed, as it may impair the intrinsic safety.

AVERTISSEMENT:
La substitution de composants peut compromettre la sécurité intrinséque.

WARNING:
To prevent ignition of flammable or combustible atmospheres, disconnect power before servicing.

AVERTISSEMENT:
Risque d'explosion. Avant de déconnecter l'equipement, couper le courant ou s'assurer que débrancher tant que l'emplacement est désigné non dangereux.

WARNING:
Explosion Hazard. Do not disconnect equipment when a flammable or combustible atmosphere is present.

AVERTISSEMENT:
Risque d'explosion. Ne pas débrancher tant que le circuit est sous tension, a moins qu'il ne s' agisse d'un emplacement non dangereux.

Maximum operating parameters of the "COM" port for use in Non-Hazardous areas shall not exceed 3.0V, 300mA and 240mW

Specific Conditions for Safe Use

The following instructions must be adhered to when the PSD is used in hazardous locations and potentially explosive atmospheres.

FM Installations

Intrinsically Safe Applications
Class I, II, III Division 1, Groups A-G

The PSD shall be installed in compliance with the enclosure, mounting, spacing and segregation requirements of the ultimate application.

Connections shall not be made to the communications “COM” port in Hazardous (Classified) Locations

The maximum operating parameters fo the “COM” port for use in Non-Hazardous areas shall not exceed 3.0V , 300uA, and 240 uW.

Nonincendive Applications
Class I, Division 2, Groups A-D

The PSD shall be installed in compliance with the enclosure, mounting, spacing and segregation requirements of the ultimate application.

Connections shall not be made to the communications “COM” port in Hazardous (Classified) Locations.

The maximum operating parameters fo the “COM” port for use in Non-Hazardous areas shall not exceed 3.0V , 300uA, and 240 uW.

CSA Installations

Intrinsically Safe Applications
Class I, Division 1, Groups A-D

The Model PSD must be installed per drawing No. 100-100-55 to be intrinsically safe.

Connections shall not be made to the communications “COM” port in Hazardous (Classified Locations)

The PSD is of open type unit Certified as a component for use only in other equipment where the suitability of the combination is to be determined by the authority having jurisdiction.

Nonincendive Applications
Class I, Division 2, Groups A-D

Connections shall not be made to the communications “COM” port in Hazardous (Classified Locations)

The PSD is of open type unit Certified as a component for use only in other equipment where the suitability of the combination is to be determined by the authority having jurisdiction.

General Locations

The PSD is of open type unit Certified as a component for use only in other equipment where the suitability of the combination is to be determined by the authority having jurisdiction.

European Union Installations
(ATEX 2014/34/EU Directive)

Intrinsically Safe Applications
II 1 G Ex ia IIC

The model PSD is intrinsically safe. It can be used in potentially explosive atmospheres and can only be connect-ed to certified intrinsically safe associate equipment. This combination must be compatible with regards to intrinsic safety.

The specific electrical parameters of the PSD model are:

Ui : 29.1V; Ii : 109mA; Ri : 71.12Ohms; Pi : 793mW; *Ci : 31.55uF; Li : 0

*Ci : 31.55uF is given for Ui : 6.2V internally limited by voltage limiters.

The electrical parameters of the certified associated intrinsically safe apparatus must not exceed any of the following values:

Uo<=29.1VDC; Io<=109mA; Po<= 0.793W.

The “COM” port and the “VIEW” switch must not be used in hazardous locations.

The equipment must not be submitted to mechanical impacts or friction.

Nonincendive, Type n Applications - Zone 2
II 3 G Ex nA IIC T4

The PSD shall be installed in compliance with the enclosure, mounting, spacing and segregation requirements of the ultimate application.

Connections shall not be made to the communications “COM” port in Hazardous (Classified) Locations.
The maximum operating parameters of the “COM” port for use in Non-Hazardous areas shall not exceed 3.0V , 300uA and 240uW.

On installation the PSD shall be provided with supply transient protection external to the apparatus such that the voltage at the supply terminals of the PSD does not exceed 119V peak or 119Vdc.

Appendix A - PSD in Safety Instrumented Systems

The PSD is not intended for use as part of a Safety Function but can be considered 'interference free' when added to a safety critical loop for monitoring purposes.

The PSD can be connected in 2 ways, either directly in the loop or with a Loop Maintenance Zener Diode (-LMD option) provided at input terminals allowing the PSD to be removed from the loop without interrupting loop continuity. (See Figures 1A & 1B).

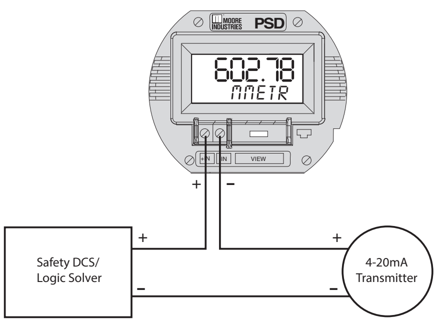


Figure 1A. *PSD Monitor in Safety Loop*

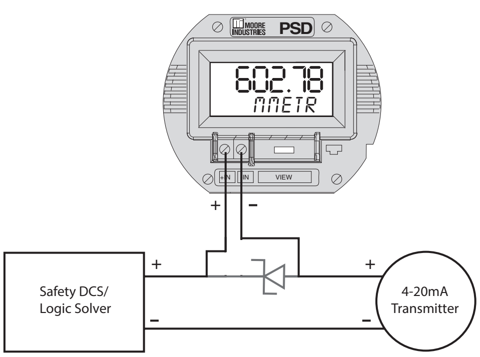


Figure 1B. *PSD Monitor with Loop Maintenance Diode option in Safety Loop*

Failure Rate Data

The FMEDA (Failure Mode, Effects and Diagnostic Analysis) process only considers components of which failures could be reasonably considered to impact the safety function. This FMEDA considers only the input circuit of the PSD and how it may affect the safety critical loop it is connected to. The failure rate of the PSD instrument and function is not considered here.

The PSD is internally redundant at the field terminals. The only internal single faults that could possibly open the loop are solder joints and connectors. These are taken care of by the LMD option (Figure 1B), which is a zener diode attached to the bottom of the field terminal block. The only faults it cannot eliminate are the field connections themselves, where the field wires attach to the terminal block.

PSD configuration 1A:
Total = 16 FITs

PSD configuration 1B:
Total = 11 FITs

All of the above input circuit failures will result in the loop current changing outside its normal operating range (3.6-21.6 mA) which is assumed to be detected by the DCS/Logic solver.

Failure Definitions

A FIT, Failure in Time, is a unit measure for failures, indicating one failure per 1,000,000,000 (10^9) hours.

A device failure is defined as a failure which causes any of the following:

- The loop current to change by more than 2%
- The output current to change outside its normal 3.6-21.6 mA operating range.

A safe (S) failure is defined as a failure which causes:

- The loop current to change outside its normal 3.6-21.6 mA operating range.

A dangerous (D) failure is defined as a failure which causes:

- The loop current to change by more than 2% AND the output current remains in normal 3.6-21.6 mA operating range.

PSD

Methodology

This FMEDA is designed to provide the end user with sufficient information to construct a safety argument supporting the application of the subject device within a safety instrumented system (SIS). The FMEDA approach is consistent with the hardware requirements of IEC61508-2:2010.

For full certification of the safety application, all requirements of IEC 61508 must be considered by the customer.

The failure rate and modes used in the analysis for the PSD were calculated using the Exida FMEDA tool. This tool contains a proprietary database derived from Telcordia, SN29500, HRBD5, MIL HDBK-217F, among others. It is expected that the data used and calculations employed return a result that is conservative against actual field failure in environments with average stress.

The user is responsible for determining the fitness of the data provided in this manual to any specific environment. For industrial plant sites with high environment stress or environment profile that is different from the one given in the assumptions below, the user must multiply the provided data with an appropriate factor reflecting the difference of the operating conditions from the reference conditions.

Assumptions

a. For the purpose of these assumptions 'device' will be taken to mean the 'equipment' which is the subject of this FMEDA.
b. Only a single component failure will fail the entire 'device'.
c. Failure rates are constant; wear-out mechanisms are not included.
d. Propagation of failures external to the device is not considered.
e. All reasonably expected component failure modes are considered.
f. The normal operating range of an analog transmitter is taken to be 3.6mA to 21.6mA.
g. The reference ambient temperature is +40°C.
h. The environmental profile is average for an industrial environment and can be compared to the Ground Benign classification of MIL-HDBK-217F and the reference environment of SN 29500 as well as Telcordia, HRD5, IEC 62380, RIAC 217+, among others.
i. The input loop is a 4-20mA current loop.
j. The input loop is monitored for excessively high and low loop current. In other words any out of range current will be detected as a fault.

RETURN PROCEDURES

To return equipment to Moore Industries for repair, follow these four steps:

1. Call Moore Industries and request a Returned Material Authorization (RMA) number.

Warranty Repair –

If you are unsure if your unit is still under warranty, we can use the unit's serial number to verify the warranty status for you over the phone. Be sure to include the RMA number on all documentation.

Non-Warranty Repair –

If your unit is out of warranty, be prepared to give us a Purchase Order number when you call. In most cases, we will be able to quote you the repair costs at that time. The repair price you are quoted will be a "Not To Exceed" price, which means that the actual repair costs may be less than the quote. Be sure to include the RMA number on all documentation.

2. Provide us with the following documentation:
   a) A note listing the symptoms that indicate the unit needs repair
   b) Complete shipping information for return of the equipment after repair
   c) The name and phone number of the person to contact if questions arise at the factory

3. Use sufficient packing material and carefully pack the equipment in a sturdy shipping container.

4. Ship the equipment to the Moore Industries location nearest you.

   The returned equipment will be inspected and tested at the factory. A Moore Industries representative will contact the person designated on your documentation if more information is needed. The repaired equipment, or its replacement, will be returned to you in accordance with the shipping instructions furnished in your documentation.

WARRANTY DISCLAIMER

THE COMPANY MAKES NO EXPRESS, IMPLIED OR STATUTORY WARRANTIES (INCLUDING ANY WARRANTY OF MERCHANTABILITY OR OF FITNESS FOR A PARTICULAR PURPOSE) WITH RESPECT TO ANY GOODS OR SERVICES SOLD BY THE COMPANY. THE COMPANY DISCLAIMS ALL WARRANTIES ARISING FROM ANY COURSE OF DEALING OR TRADE USAGE, AND ANY BUYER OF GOODS OR SERVICES FROM THE COMPANY ACKNOWLEDGES THAT THERE ARE NO WARRANTIES IMPLIED BY CUSTOM OR USAGE IN THE TRADE OF THE BUYER AND OF THE COMPANY, AND THAT ANY PRIOR DEALINGS OF THE BUYER WITH THE COMPANY DO NOT IMPLY THAT THE COMPANY WARRANTS THE GOODS OR SERVICES IN ANY WAY.

ANY BUYER OF GOODS OR SERVICES FROM THE COMPANY AGREES WITH THE COMPANY THAT THE SOLE AND EXCLUSIVE REMEDIES FOR BREACH OF ANY WARRANTY CONCERNING THE GOODS OR SERVICES SHALL BE FOR THE COMPANY, AT ITS OPTION, TO REPAIR OR REPLACE THE GOODS OR SERVICES OR REFUND THE PURCHASE PRICE. THE COMPANY SHALL IN NO EVENT BE LIABLE FOR ANY CONSEQUENTIAL OR INCIDENTAL DAMAGES EVEN IF THE COMPANY FAILS IN ANY ATTEMPT TO REMEDY DEFECTS IN THE GOODS OR SERVICES , BUT IN SUCH CASE THE BUYER SHALL BE ENTITLED TO NO MORE THAN A REFUND OF ALL MONIES PAID TO THE COMPANY BY THE BUYER FOR PURCHASE OF THE GOODS OR SERVICES.

ANY CAUSE OF ACTION FOR BREACH OF ANY WARRANTY BY THE COMPANY SHALL BE BARRED UNLESS THE COMPANY RECEIVES FROM THE BUYER A WRITTEN NOTICE OF THE ALLEGED DEFECT OR BREACH WITHIN TEN DAYS FROM THE EARLIEST DATE ON WHICH THE BUYER COULD REASONABLY HAVE DISCOVERED THE ALLEGED DEFECT OR BREACH, AND NO ACTION FOR THE BREACH OF ANY WARRANTY SHALL BE COMMENCED BY THE BUYER ANY LATER THAN TWELVE MONTHS FROM THE EARLIEST DATE ON WHICH THE BUYER COULD REASONABLY HAVE DISCOVERED THE ALLEGED DEFECT OR BREACH.

RETURN POLICY

For a period of thirty-six (36) months from the date of shipment, and under normal conditions of use and service, Moore Industries ("The Company") will at its option replace, repair or refund the purchase price for any of its manufactured products found, upon return to the Company (transportation charges prepaid and otherwise in accordance with the return procedures established by The Company), to be defective in material or workmanship. This policy extends to the original Buyer only and not to Buyer's customers or the users of Buyer's products, unless Buyer is an engineering contractor in which case the policy shall extend to Buyer's immediate customer only. This policy shall not apply if the product has been subject to alteration, misuse, accident, neglect or improper application, installation, or operation. THE COMPANY SHALL IN NO EVENT BE LIABLE FOR ANY INCIDENTAL OR CONSEQUENTIAL DAMAGES.

MOORE INDUSTRIES

United States • info@miinet.com
Tel: (818) 894-7111 • FAX: (818) 891-2816

Australia • sales@mooreind.com.au
Tel: (02) 8536-7200 • FAX: (02) 9525-7296

Belgium • info@mooreind.be
Tel: 03/448.10.18 • FAX: 03/440.17.97

The Netherlands • sales@mooreind.nl
Tel: (0)344-617971 • FAX: (0)344-615920

China • sales@mooreind.sh.cn
Tel: 86-21-62491499 • FAX: 86-21-62490635

United Kingdom • sales@mooreind.com
Tel: 01293 514488 • FAX: 01293 536852